

# THE ELMIDAE (COLEOPTERA) OF TRINIDAD AND TOBAGO

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## SYNOPSIS

The Elmidae of Trinidad and Tobago are revised and a key is given to all of the species known to occur in the Lesser Antilles. A key to the larvae is included with the key to the adults, and the larvae of all species known to occur in the Lesser Antilles may now be distinguished. One new species and one new subspecies are described. The biology and continental relationships of the species are discussed.

## INTRODUCTION

THIS revision of the Elmidae of Trinidad and Tobago was begun over 30 years ago, but other interests prevented its completion until now. Although a detailed revision of the larvae is not presented here, larvae of all species are included in the key to the adults. All of the Elmidae known from the Lesser Antilles are found on the two islands except *Hexanochorus caraibus* (Coquérel). This species was described from Martinique and Guadeloupe, and I have seen specimens from St. Vincent. I have little doubt that in due course it will be found on Trinidad and Tobago, and it is therefore included in the key. Three of the six species now known to occur on Trinidad and Tobago have previously been recorded from these islands: *Hexacylloepus smithi* (Grouvelle) (Darlington, 1936), *Elsianus clypeatus* Hinton (Hinton, 1936), and *Microcylloepus carinatus* Hinton (Hinton, 1940b).

## MATERIALS AND METHODS

This revision is based upon 5,329 specimens from the islands of Trinidad and Tobago, most of which were collected by me in October and November of 1937.

The number of each species is as follows:

<i>Phanocerus congener</i> Grouvelle	. . . . .	54
<i>Elsianus clypeatus</i> Hinton	. . . . .	661
<i>Neoelmis pusio</i> sp. n.	. . . . .	189
<i>Microcylloepus carinatus</i> Hinton	. . . . .	645
<i>Hexacylloepus smithi</i> (Grouvelle)	. . . . .	1913
<i>Heterelmis simplex codrus</i> subsp. n.	. . . . .	1867
	Total	5,329

The holotypes and duplicate series have been deposited in the British Museum (Natural History); the remainder of the material is in my own collection.

All of my collecting in Trinidad was done in the northern mountainous part. Sometimes two quite different rivers on the island bear the same name, e.g. Oropuche. In order to avoid confusion and for ease in identifying the rivers and streams from which collections were made, they are here listed according to wards:

<i>Diego Martin</i>	<i>Valencia</i>
Maraval	Cuare
<i>St Ann's</i>	<i>Arima</i>
St Ann's	Arima
Curumpalo	Mausica
Curucaye	<i>Blanchisseuse</i>
Cimaronero	Marianne
St Cruz	<i>Manzanilla</i>
<i>Tacarigua</i>	Cunapo
Tacarigua	Oropuche
St Joseph	
Maracas	
Garden	

The species were described for the most part under a magnification of  $\times 75$ . The drawings were made with the aid of a camera lucida. By the term microscopic punctures is meant punctures that are half or less than half as wide as the facets of the eyes. The electron micrographs, e.g. Pl. 3, fig. 14, clearly show that what has previously been referred to as asperate in the Elmidae is a reticulate microsculpture. Subjectivity in describing the size of punctures is generally removed by comparing their diameter to that of some other structure, such as the eye facets. Even so, however, a large element of subjectivity may remain. This is particularly true of descriptions of the strial punctures of the elytra, which often have their top sides gradually sloping (see Pl. 5, fig. 22), and their apparent size varies with the part of the slope taken as the beginning of the puncture, which in turn depends upon the angle of the incident light. The geometry of the surfaces and the types of setae and microtrichia are particularly well shown by scanning electron micrographs. One difficulty

was encountered with these: when the specimen is sufficiently well coated with metal to prevent undue charging of the setae, many of the finer punctures may be filled in by the metal so that the surface then appears to be less densely punctate than in fact it is. In the figures of the male genitalia, the setae are only approximately indicated. The term pronotal disk refers to the whole of the area between the sublateral carinae. The abdominal sternites are numbered according to the externally visible ones, and no account is taken of externally concealed sternites.

#### BIOLOGY

Adult Elmidae belong to two quite different groups according to their biology and structure. The first and more primitive group includes the subaquatic species that lack a plastron but have the body fairly densely clothed with long, hydrofuge hairs. When these beetles are covered by water, for instance when they enter water to oviposit, the hairs on the body hold a film or bubble of air that acts as a temporary or collapsible physical gill. As oxygen is removed from the bubble, equilibrium tends to be restored by oxygen entering it from the surrounding water rather than by nitrogen leaving because nitrogen is much less soluble than oxygen and so passes through the water-air interface of the bubble more slowly. Nevertheless, a little nitrogen is continually leaking out, and in due course the bubble becomes too small to be effective as a gill and the beetle has to come to the surface to renew its bubble.

The second and more specialised group are the wholly aquatic plastron-breathers. These normally remain beneath the surface of the water all of their lives. On much of the ventral surface and often also on the epipleura, legs, and sometimes even on the dorsal surface they have a plastron. This consists of an air film of constant volume and an extensive water-air interface. The air film is held in position by very fine and dense hair-like or scale-like hydrofuge microtrichia. The microtrichia prevent wetting of the plastron under the hydrostatic pressures to which the beetles are normally subjected. The plastron-breathers can remain under water indefinitely and extract through their plastron all of the oxygen they require providing the water is well-aerated.

The Elmidae that are now plastron-breathers have been independently evolved on a number of occasions from different stocks of the subaquatic forms. Only a relatively slight morphological change need take place in order to alter the structures that will support a gas bubble that behaves as a collapsible physical gill into structures that will hold a gas film against a pressure difference; the setae or microtrichia only have to become a little denser (Hinton, 1969).

Both adults and larvae feed on aquatic plants, probably chiefly on algae. The larvae have anal retractile tracheal gills. The early instars are apneustic, but in the final larval instar the first pair of thoracic spiracles and all eight pairs of abdominal spiracles are functional. Pupation occurs in moss or soil close to but above the water line. The primitive groups are active fliers throughout adult life. The

plastron-breathers often fly after emergence from the pupal cuticle, and they are occasionally collected at light at night. However, once they have entered the water and begun living there, the flight muscles degenerate and they are no longer capable of flying.

#### CONTINENTAL RELATIONSHIPS

The islands of Trinidad and Tobago, like the other islands of the Lesser Antilles, are on the continental shelf. Trinidad is less than 14 miles from the Venezuelan mainland, and between it and the mainland are several islands, so that the greatest stretch of open sea between the mainland and Trinidad is less than 8 miles. The sea between Trinidad and the mainland is no more than about 15 metres deep, and Trinidad has evidently been connected with the mainland until relatively recently. Many writers, e.g. Darlington (1957), have drawn attention to the fact that, zoogeographically, Trinidad and associated islands are part of the mainland. Trinidad has a continental fauna of all of the main classes of vertebrates, and many of the species are the same as those on the mainland.

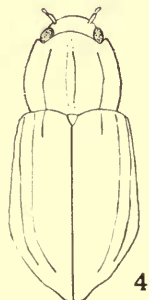
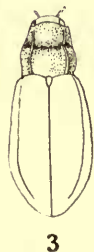
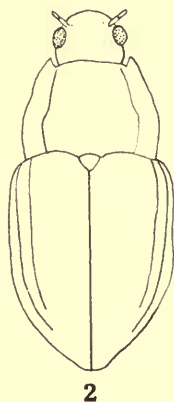
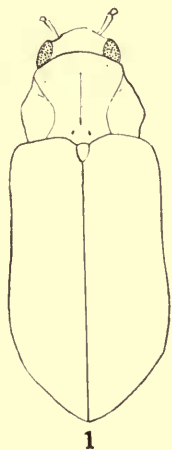
Two of the six species of Elmidae found in Trinidad and Tobago also occur on the mainland. *Elsianus clypeatus* Hinton has been found in Caracas, and *Heterelmis simplex* Sharp was first described from Guatemala. Very little is now known of the Venezuelan Elmidae, but it may be supposed that all of the species of the islands will be found in due course in Venezuela. As might be expected, the Elmidae of the Lesser Antilles are much more closely related to those of Central and South America than they are to those of the Greater Antilles. Because of the very narrow stretch of open water between Trinidad and the mainland, it is not certain whether the island species arrived after land connections with Venezuela were broken or were left behind when such connections disappeared, but the latter hypothesis seems more likely.

All of the species in Trinidad and Tobago belong to genera that are well-represented on the mainland. Five species of *Phanocerus* Sharp have been described, and of these *P. congener* Grouvelle appears to be most closely related to *P. clavicornis* Sharp of Central and South America. About 34 species of *Elsianus* Sharp are known. *Elsianus clypeatus* Hinton belongs to a species-group that includes only two other known species, *E. tarsalis* Hinton of Costa Rica and Ecuador and *E. isus* Hinton of Brazil. Some 25 species of *Neoelmis* Musgrave have been described. Of these, *N. pusio* Hinton most closely resembles *N. apicalis* (Sharp), which occurs from Mexico to Peru. The Brazilian species of *Neoelmis* have been revised (Hinton, 1940c), but none of these are closely related to *N. pusio*. About 23 species of *Microcylloepus* Hinton are known, but *M. carinatus* (Hinton) is not closely related to any of them. It is certainly not closely related to any of the Brazilian species (see Hinton, 1940a). Some 22 species of *Hexacylloepus* Hinton are known. *H. smithi* (Grouvelle) belongs to the *H. ferruginea* (Horn) species-group, and its nearest relative appears to be *H. abditus* (Hinton) of Mexico. No less than 18 species of *Heterelmis* have been described, and, as already noted, the form in the islands is no

more than subspecifically distinct from the Guatemalan *H. simplex simplex* Sharp. Full diagnoses of the six genera are given in my monograph of the Mexican Elmidae (Hinton, 1940b) and need not be repeated here.

## KEY TO THE ELMIDAE OF TRINIDAD AND TOBAGO

- 1 Dorsal surface (Pl. 1, fig. 3) densely clothed with long hairs that are often erect; ventral surface (Pl. 1, figs 1-2, 4-6) somewhat similarly clothed. Body without a plastron. Tibiae without grooming fringes. Front coxae strongly transverse. Adults subaquatic but do not remain for long periods beneath the surface of the water. Larva flattened and onisciform but if cylindrical propleura of each side are divided into three parts . . . . . 2
- Dorsal surface not densely clothed with long hairs; ventral surface with a plastron. Tibiae with one or two apical grooming fringes. Front coxae more or less round. Adults normally live entirely beneath the surface of the water. Larva cylindrical and propleura on each side entire or divided into only two parts . . . . . 3



FIGS 1-4. (1) *Phanocerus congener*. (2) *Heterelmis simplex codrus*. (3) *Neoelmis pusio*. (4) *Hexacylloepus smithi*.



- 2 Pronotum on each side without a longitudinal sulcus on basal two-fifths; with a deep transverse depression that is on apical third at middle and apical fifth or sixth at sides. Length 3.0-3.5 mm. *Larva* cylindrical, not flattened; propleura of each side divided into three parts. Martinique, Guadeloupe, St Vincent, Trinidad (?)  
*Hexanochorus caraibus* (Coquérel) (p. 247)
- Pronotum (Text-fig. 1) on each side with a longitudinal sulcus on basal two-fifths; without an apical transverse depression. Length 1.8-2.4 mm. *Larva* onisciform and flattened; propleura on each side divided into two parts. Grenada, Tobago, Trinidad . . . . .  
*Phanocerus congener* Grouvelle (p. 253)
- 3 Each elytron with a short accessory stria at base between first and second striae. Each testis composed of three sperm tubes. Length 3.0-3.5 mm. *Larva* with segments 2-7 of abdomen with three longitudinal sutures between sternum and middle of tergum. Venezuela, Trinidad, Tobago .  
*Elsianus clypeatus* Hinton (p. 254)
- Elytra without accessory striae. Each testis composed of two sperm tubes. Length less than 2.5 mm. *Larva* with segments 2-7 of abdomen with two longitudinal sutures between sternum and middle of tergum . . . . . 4
- 4 Pronotum (Text-fig. 3) with a broad and deep transverse depression; pronotal disk without a median longitudinal depression. Eacy elytron (Text-fig. 3) with a single sublateral carina. Length 1.4-1.7 mm. *Larva* with ninth abdominal segment approximately four times as long as wide. Prosternum behind coxae three times as wide as long. Meso- and meta-pleura on each side divided into two parts; meso- and meta-sternum with middle of posterior margin only moderately produced, not forming a conspicuous tubercle. Trinidad, Tobago  
*Neoelmis pusio* sp. n. (p. 256)
- Pronotum without a distinct transverse depression or if one is present there is also a median discal depression (Text-fig. 12). Each elytron with two sublateral carinae. Length 1.7-2.4 mm. *Larva* with ninth abdominal segment less than three times as long as wide; prosternum behind coxae not twice as wide as long; meso- and meta-pleura on each side often divided into three parts; meso- and metasternum with middle of posterior margin strongly produced to form a narrow tubercle about half as long as a tarsal claw . . . . . 5
- 5 Pronotum with a deep transverse depression at apical third (Text-fig. 12). Hypomera and elytra epipleura without a plastron. Elytra with third interval at base strongly carinate (Text-fig. 12). *Larva* without a row of small teeth or tubercles on anterior margin of head and thoracic and abdominal tergites without very well-defined rows of erect, cylindrical, spinose tubercles. Trinidad, Tobago  
*Microcylloepus carinatus* Hinton (p. 259)
- Pronotum without a transverse depression on apical third. Hypomera and elytral epipleura with extensive plastrons. Elytra with third interval at base flat. *Larva* with teeth or projecting tubercles along anterior margin of head or with tergites of thorax and abdomen with very well-defined rows of erect, cylindrical, spinose tubercles . . . . . 6
- 6 Pronotum (Text-fig. 4) with a median longitudinal depression extending from base nearly to apex. Elytra with fourth interval at base subcarinate. Surface of pronotum and elytra with numerous granules. Hypomera with a transverse plastron strip that reaches edge of pronotum. Front tibia with a single grooming fringe. *Larva* with a row of teeth or projecting tubercles along anterior margin of head; tergites of thorax and abdomen without very-well defined rows of erect, cylindrical, spinose tubercles. Grenada, Tobago, Trinidad  
*Hexacylloepus smithi* (Grouvelle) (p. 261)
- Pronotum without a large, median longitudinal depression. Elytra with fourth interval at base flat. Surface of pronotum and elytra punctate, not granulate. Hypomera with plastron strip longitudinal and everywhere far from edge of pronotum.

Front tibia with two grooming fringes. Larva with a tooth on each antero-lateral angle of head but without a row of teeth or projecting tubercles along middle of anterior margin; tergites of thorax and abdomen with very well-defined rows of erect, cylindrical, spinose tubercles. Trinidad, Tobago

*Heterelmis simplex codrus* subsp. n. (p. 263)

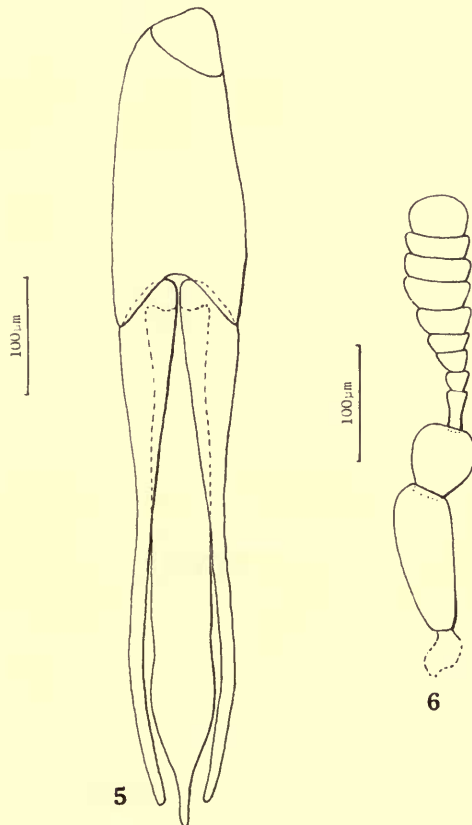
DESCRIPTIONS OF THE SPECIES

*Phanocerus congener* Grouvelle

(Pl. I; Text-figs 1, 5, 6)

*Phanocerus congener* Grouvelle, 1898, *Notes Leyden Mus.* 20: 46. Holotype, GRENADA: Balthazar (BMNH) [examined].

♂. Length 1.8–2.4 mm; breadth 0.8–1.0 mm. Body subparallel, moderately convex. Cuticle brownish, moderately shining; eyes black. Dorsal surface densely clothed with fine, suberect to erect, brownish setae that on head and pronotum are about a third as long as eyes but on elytra (Pl. I, fig. 3) are more often more than half as long as eyes; between long setae with numerous much shorter, semi-recumbent hairs (Pl. I, fig. 3). Ventral surface with long,



FIGS 5-6. *Phanocerus congener*. (5) Dorsal view of male genitalia. (6) Antenna.

semi-erect to erect hairs between which are much shorter and more recumbent hairs (Pl. 1, figs 4-6). *Head* with apical segments of antenna forming a distinct club (Text-fig. 6). *Clypeus* with anterior margin truncate; angle on each side broadly rounded. *Labrum* with anterior margin feebly and broadly, arcuately emarginate, angle on each side broadly rounded; anterior margin with transverse fringe of fine, golden hairs; on each side just behind angle with a dense tuft of longer golden hairs. *Pronotum* with broadest point, which is just in front of base, broader than long (0.84 mm: 0.63 mm) and base broader than apex (0.79 mm: 0.58 mm). Base in front of scutellum not distinctly gibbous. *Sublateral impressions* as shown in Text-fig. 1. Base in front of scutellum not distinctly gibbous. *Elytra* with discal stria punctures often subquadrate, usually one-half as broad as intervals, and separated longitudinally usually by a little more than their diameters; beyond basal two-fifths stria punctures become much smaller and more shallow towards apex. *Genitalia* (Text-fig. 5) with median lobe abruptly narrowed near apex and extending a little beyond apices of parameres.

♀. Externally similar to male.

#### SPECIMENS EXAMINED.

Holotype, sex undetermined, GRENADA: (windward side) Balthazar (*H. H. Smith*). In the British Museum (Natural History).

TRINIDAD: 4 ex., St Anns' River, 45 ex., Maracas Valley, 1 ex., Cuare River, 1 ex., Marianne River, all 28.x.-5.xi. 1935 (*H. E. Hinton*); 1 ex., Arima River, 16. xii. 1969 (*H. B. N. Hynes*). TOBAGO: 1 ex., Providence River, 1 ex., Courland River, both 6.xi. 1937 (*H. E. Hinton*).

COMPARATIVE NOTES. This is closely related to *P. clavicornis* Sharp, 1882, which is widely distributed in Central America and northern South America. The male genitalia of the two species are very similar (cf. Hinton, 1940b, fig. 50). In *P. clavicornis* the base of the pronotum in front of the scutellum is strongly gibbous and the sublateral impression on each side of the pronotum is bent outwards almost at right angles, so that it reaches the edge of the pronotum just beyond the middle of its length instead of near its apex as in *P. congener* (Text-fig. 1). In *P. clavicornis* the base of the head behind the posterior third of the eyes has a paler band when viewed in certain lights, owing to the different arrangement of the fine setae, which reflect the light differently to those on the anterior part of the head. In *P. congener* no distinct paler band appears on the base of the head as the specimen is turned in a beam of light.

### *Elsianus clypeatus* Hinton

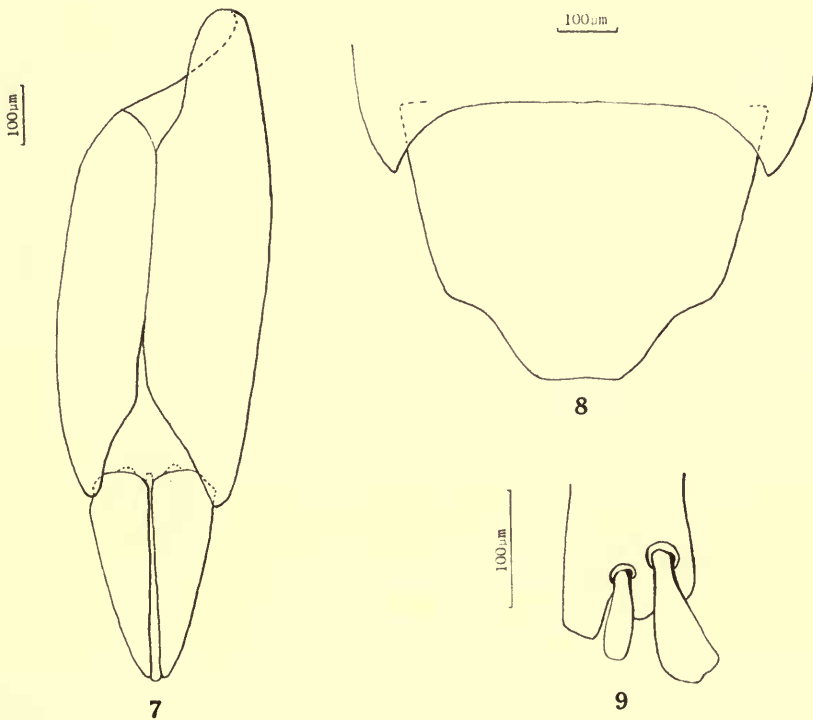
(Pl. 2; Text-figs 7, 9)

*Elsianus clypeatus* Hinton, 1936, *Trans. R. ent. Soc. Lond.* 85: 424. Holotype ♀, TRINIDAD: Maracas (BMNH) [examined].

♂. Length 3.0-3.5 mm; breadth 1.2-1.5 mm. Cuticle feebly shining and rufo-piceous to black with antennae, mouth-parts, and legs paler; if black, femora are usually also black. *Head* with granules like those of pronotal disk but slightly denser. *Clypeus* with anterior margin moderately strongly bisinuate; angle on each side obtuse, rounded, and sides near anterior angles feebly dilated. *Labrum* with a transverse fringe of fine, golden setae about as long as first two tarsal segments together. *Pronotum* at broadest point, which is at about basal third, about as broad as long (1.0 mm) and base broader than apex (0.92 mm: 0.73 mm). *Sublateral carinae* broad, prominent, extending from base to about apical fifth;



inner (dorso-mesal) margins of carinae sharp. Disk without a median longitudinal depression but with a scarcely defined median longitudinal line (Pl. 2, fig. 7) that extends from a short distance in front of scutellum to apical third; without a distinct transverse impression. Surface granulate as shown in Pl. 2, fig. 7. *Hypomera* without plastron-free areas. *Elytra* with apices conjointly broadly produced for a short distance and then individually obliquely truncate to apex; at extreme distal end the apices are feebly divergent. Epipleura with plastron absent only on extreme apex. Intervals flat or nearly so; sublateral carinae absent; surface of discal intervals (Pl. 2, fig. 9) granulate like pronotal disk. Strial punctures as shown in Pl. 2, fig. 9, but on middle of disk subquadrate, about as wide as intervals, and separated longitudinally by about their diameters. *Scutellum* moderately convex. *Prosternum* with plastron on sides except near apex; when seen from side with anterior two-thirds (not including process) moderately strongly bent ventrally. *Metasternum* (Pl. 2, fig. 10) with a distinct, irregularly oval depression on each side which is nearer hind than middle coxa. *Abdomen* with plastron absent on discal area of first four sternites and anterior three-fifths of disk of fifth sternite. Disk of first sternite strongly depressed; sublateral carinae low, broad, not distinctly extending to hind margin of segment. Second sternite with anterior discal area slightly depressed. Fifth sternite with apex strongly convex; with numerous long, golden setae on apical margin and apical sides as far back as flanges that fit into elytra. *Legs* with femora entirely clothed with a plastron; tibiae with plastron indistinct but usually evident on front tibiae; front tibia with a single grooming fringe on anterior ventral face; middle tibiae with grooming fringes on both anterior and posterior faces; hind tibiae with a single grooming fringe on posterior ventral side. Hind tibia with inner or posterior spur dilated (Text-fig. 9).



FIGS 7-9. *Elsianus clypeatus*. (7) Dorsal view of male genitalia. (8) Fifth abdominal sternite of male. (9) Inner view of apex of hind tibia of male.

♀. Externally similar to male except as follows: (1) clypeus with anterior margin less strongly bisinuate; (2) golden hairs of transverse fringe of labrum much shorter than labrum instead of longer than labrum; (3) metasternum with oval depression on each side of disk absent or scarcely noticeable; (4) disk of first abdominal sternite much less strongly depressed; (5) anterior part of disk of second abdominal sternite not distinctly depressed; (6) fifth abdominal sternite not gibbous at apex and without the apical and postero-lateral fringes of very long, golden setae; and (7) inner spur of hind tibia only very slightly broader than outer spur.

#### SPECIMENS EXAMINED.

Holotype ♀, TRINIDAD: Maracas, 28.v.1924 (*C. L. Withycombe*). In the British Museum (Natural History).

VENEZUELA: 3 ex., Caracas. TRINIDAD: 18 ex., Maraval River, 2. xi. 1937 (*H. E. Hinton*); 47 ex., St Ann's. at light, 28.x.1937 (*H. E. Hinton*); 16 ex., Curumpalo River, 2. xi. 1937 (*H. E. Hinton*); 1 ex., Curucaye River, 2. xi. 1937 (*H. E. Hinton*); 2 ex., Cimaronero River, 2. xi. 1937 (*H. E. Hinton*); 200 ex., St Cruz River, 2. xi. 1937 (*H. E. Hinton*); 84 ex., Tacarigua River, 31. x. 1937 (*H. E. Hinton*); 3. ex, St Joseph River, 16. xii. 1969 (*H. B. N. Hynes*); 26 ex., Garden River, 31. x. 1937 (*H. E. Hinton*); 186 ex., Maracas Valley, 29-31. x. 1937 (*H. E. Hinton*); 3 ex., Cuare River, 5. xi. 1937 (*H. E. Hinton*); 58 ex., Mausica River, 31. x. 1937 (*H. E. Hinton*); 14 ex., Arima River, 16. xii. 1969 (*H. B. N. Hynes*). TOBAGO: 1 ex., Providence River, 2 ex., Hillsborough West River, both 6. xi. 1937 (*H. E. Hinton*).

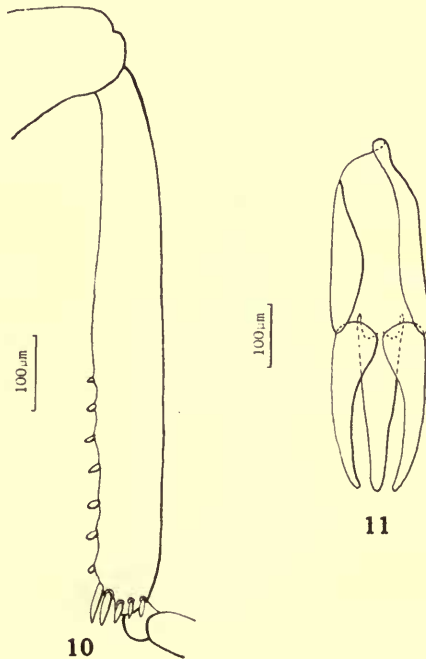
COMPARATIVE NOTES. In the key to the Brazilian species (*Hinton, 1946*) this traces to *E. isus* *Hinton*, to which it is very closely related. These two species, together with *E. tarsalis* *Hinton* (1936), which occurs from Costa Rica to Ecuador, constitute a species-group characterised by having the apices of the elytra dehiscent, each elytron being separately rounded at the extreme apex, and by the unusual (for *Elsianus*) secondary sexual characters of the male. *E. isus* is much the largest of the three species (4.0-4.9 mm). The secondary sexual characters of the male are identical to those of *E. clypeatus*, and the male genitalia of the two are very similar. Apart from its larger size, *E. isus* may be distinguished by the shallow and broad median longitudinal depression on the pronotal disk. *E. tarsalis* is a much smaller species (2.8 mm long), and the male has the inner spur of the hind tibia strongly flexed inwards so that it is normal to the major axis of the tibia. The male of *E. tarsalis* has a long and conspicuous spine on the ventral apex of the first segment of the middle tarsus, whereas neither *E. clypeatus* nor *E. isus* has such a spine.

#### *Neoelmis pusio* sp. n.

(Pls 3, 4; Text-figs 3, 10, 11)

♂. Length 1.4-1.7 mm; breadth 0.57 mm-0.63 mm. Body subparallel, feebly convex (Text-fig. 3). Cuticle moderately shining, rufo-piceous; antennae, mouth-parts and legs yellowish brown; ventral surface sometimes nearly colour of appendages; top of head sometimes nearly black. *Head* with a reticulate microsculpture (Pl. 3, fig. 13). Clypeus with anterior margin when seen from front truncate; angle on each side broadly rounded; surface with

microscopic punctures often separated by two to three diameters. *Pronotum* across broadest point, which is at about basal third, about as broad as long (0.47 mm) and base broader than apex (0.45 mm: 0.37 mm). Sublateral carinae (Pl. 3, figs 13, 14) prominent, inner margins sharp, extending from base very nearly to apex. Base in front of scutellum without carinae or gibbosities. Surface with reticulate microsculpture more distinct than that of head and distributed as shown in Pl. 3, figs 13-14; surface of disk in front of transverse depression with punctures about half as coarse as facets of eyes and usually separated by two to three diameters; posterior part of disk behind transverse depression similarly but more densely punctate and middle of posterior half of disk with a reticulate microsculpture. *Hypomera* without a plastron. Surface everywhere with a reticulate microsculpture. *Elytra* with sublateral carinae prominent. Apices moderately produced and broadly, conjointly rounded. Humeri moderately prominent. Lateral margins feebly crenate, nearly smooth. Striae absent or scarcely impressed on about apical third of middle area; discal striae (Pl. 3, fig. 15) with punctures of basal half nearly as broad as intervals between striae and separated longitudinally by about their diameters; surface of intervals with microscopic punctures separated by three or more diameters. Epipleura without plastron-free areas. *Scutellum* flat. *Prosternum* with a very narrow (about half as wide as second antennal segment) strip of plastron along sterno-notal suture that can only be seen from certain angles so that at most angles the prosternum appears to be without a plastron. When seen from side with anterior three-fifths (not including process) moderately strongly bent ventrally. Sublateral carinae indistinct to moderately prominent and parallel, not distinctly diverging anteriorly; on each side between carina and sterno-notal suture with a thick ridge. Surface with a reticulate microsculpture except on discal area in front of process, which is



FIGS 10-11. *Neelmis pusio*. (10) Hind tibia of male showing the inner row of short spines. Other setae are omitted. (11) Dorsal view of male genitalia.

punctate like anterior half of pronotal disk. -Metasternum(Pl. 4, fig. 17) with median longitudinal line complete; feebly impressed on about anterior fourth but on posterior three-fourths about as broad as basal tarsal segment; on each side of disk behind middle with a distinct oval depression separated from hind coxa by a distance equal to its diameter; bottom of oval depression with a reticulate microsculpture; surface on either side of median line strongly shining and sparsely, microscopically punctate. *Abdomen* with plastron-free areas on disk of first and second sternites except for a very thin strip of plastron on posterior margin of each; third sternite often with a small, discal, plastron-free area near anterior margin. First sternite with anterior (basal) half of disk depressed; sublateral discal carinae confined to anterior half of sternite; surface of anterior part of disk with a reticulate microsculpture. *Legs* with plastron absent on ventral surface of coxae, trochanters, and all of dorsal and sublateral parts of tibiae; plastron covering entire femora and ventral half of tibiae. Middle and hind (Text-fig. 10) tibiae with a row of fine teeth on inner margin. *Genitalia* (Text-fig. 11) with median lobe very slightly longer than parameres. Parameres evenly narrowed to apices.

♀. Externally similar to male but (1) with basal half of disk of first abdominal sternite much less strongly depressed and (2) without a row of teeth on inner margin of middle and hind tibiae.

Holotype ♂, TOBAGO: Courland River, 6.xi.1937 (*H. E. Hinton*). In the British Museum (Natural History).

Paratypes. 122 ex., with same data as holotype; TOBAGO: 4 ex., Providence River, 6. xi. 1937 (*H. E. Hinton*). TRINIDAD: 1 ex., Maracas River, 31. x. 1937 (*H. E. Hinton*); 1 ex., Maracas Valley, Constabulary, 30. x. 1937 (*H. E. Hinton*); 4 ex., Mausica River, 31. x. 1937 (*H. E. Hinton*); 2 ex., St Cruz River, 2. xi. 1937 (*H. E. Hinton*); 55 ex., Maraval River, 2. xi. 1937 (*H. E. Hinton*).

COMPARATIVE NOTES. Of the known species this is most nearly related to *N. apicalis* (Sharp) which occurs from Mexico to Peru (subspecies *N. apicalis angusta* Hinton). From both *N. apicalis apicalis* and *N. apicalis angusta* it may be distinguished by its smaller size and the reticulate microsculpture of the posterior half of the pronotal disk. The key to the subspecies given by me (Hinton, 1939) may be modified to include the new species as follows:

- 1 Pronotal disk with a reticulate microsculpture on surface of middle of posterior half.  
Trinidad, Tobago . . . . . ***Neoelmis pusio*** sp. n
- Pronotal disk with punctures about half as coarse as facets of eyes and usually separated by three to five diameters on surface of middle of posterior half . . . . . 2
- 2 Prosternal carinae distinct. Metasternum with depression on each side nearly round and separated by a distance equal to two-thirds of its diameter from hind coxa. Male genitalia with margins of parameres contiguous mesally. Mexico, Guatemala  
***Neoelmis apicalis apicalis*** (Sharp, 1882)
- Prosternal carinae indistinct. Metasternum with depression on each side about a third longer than broad and separated by a distance equal to its diameter from hind coxa. Male genitalia with basal margins of parameres not contiguous mesally.  
Peru, Bolivia . . . . . ***Neoelmis apicalis angusta*** Hinton, 1939

The teeth on the inner (ventral) side of the middle and hind tibiae of the male of *N. pusio* are very difficult to see with a binocular microscope, and the sexes are more easily distinguished by the degree to which the basal part of the disk of the first abdominal sternite is depressed.



*Microcylloepus carinatus* Hinton

(Pls 5, 6; Text-figs 12-14)

*Microcylloepus carinatus* Hinton, 1940b, *Novit. zool.* **42** : 304, figs 199-203. Holotype ♂, TRINIDAD: St Cruz River (BMNH) [examined].

*Microcylloepus carinatus* Hinton, 1945, *Entomologist*, **78** : 57-59, fig. 1.

♂. Length, 1.9-2.0 mm; breadth 0.76 mm. Cuticle shining and black or very dark rufopiceous; antennae, mouth-parts, and legs reddish brown. *Head* with punctures about a third as coarse as facets of eyes, very dense to confluent; at sides near anterior margin with an occasional low and very indistinct granule. Clypeus with anterior margin, when seen from front, scarcely noticeably, arcuately emarginate from its entire breadth; angle on each side more or less rectangular but rounded; surface sculptured like anterior region of head and also with a few low granules. Labrum on basal third at middle or basal two-thirds at sides with a transverse microsculpture; elsewhere with a few microscopic punctures. *Pronotum* across broadest point, which is at about basal two-fifths, as broad as long (0.63 mm) and base broader than apex (0.55 mm : 0.44 mm). Shape as shown in Pl. 5, fig. 23 and Text-fig. 12. Surface of disk with reticulate microsculpture distributed as shown in Pl. 5, fig. 23; surface of apical fourth of disk except near anterior margin, bottom of median depression, and basal fourth between median and sublateral carinae with punctures about half as coarse as facets of eyes and separated by two to five diameters. *Hypomera* without a plastron; surface with a reticulate microsculpture that in some lights appears to be a very dense and uniform punctation. *Elytra* with sublateral carinae very prominent (Text-fig. 12); inner carinae extending to middle. Third interval carinate on basal fifth (Pl. 5, fig. 22; Text-fig. 12). Apices broadly produced and conjointly rounded; each elytron near apex when seen from side with a conspicuous cavity for the reception of the projection of the fifth abdominal sternite. Humeri feebly gibbous. Epipleura without a plastron. Discal striae broad and feebly impressed; striae punctures on middle of disk round to subquadrate, very deep, and one-half to two-thirds as broad as scutellum; beyond middle of elytra

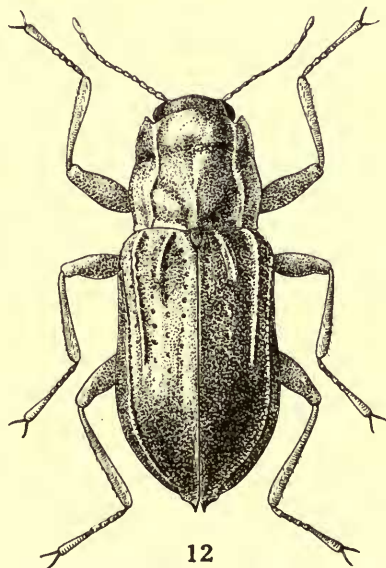
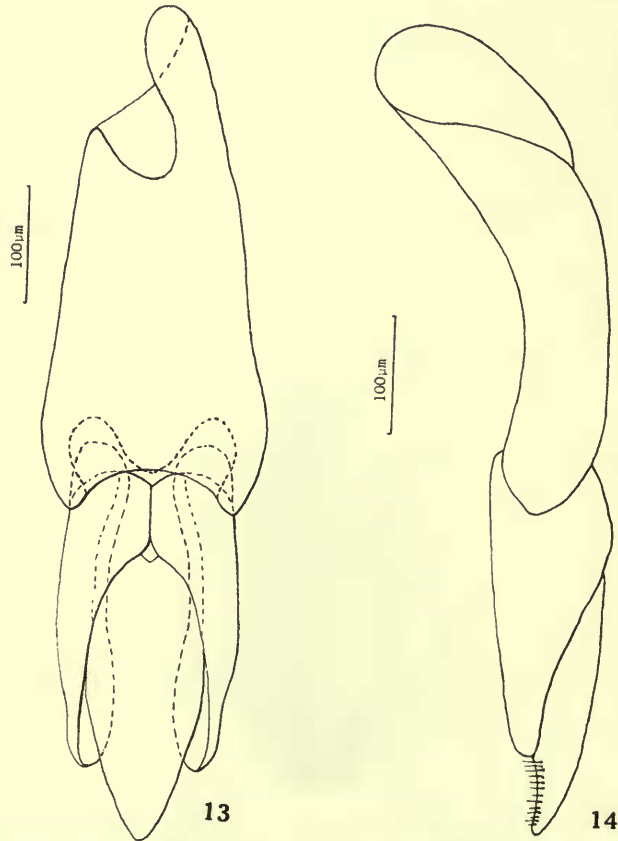


FIG. 12. *Microcylloepus carinatus*, female.

strial punctures abruptly become much finer. Surface of intervals with sparse, microscopic punctures. *Scutellum* moderately convex. *Prosternum* with plastron present everywhere between sublateral carina and sterno-notal suture except for a small oval or triangular area touching sublateral carina and coxal cavity and a small area at apex by sublateral carina; when seen from side with anterior five-sixths (not including process) gradually and feebly bent ventrally; prosternal carinae present on basal two-thirds to three-fourths, not prominent, and very feebly converging anteriorly, process with sides strongly raised so that it has a broad, deep, median longitudinal channel. *Mesosternum* with sides moderately strongly raised; with a deep, median, caudal pit. *Metasternum* with disk strongly depressed; median longitudinal impression about as broad as basal segment of middle tarsus and extending to anterior fifth; lateral discal carina sinuate and extending obliquely outwards very nearly to hind coxa; surface of disk with punctures as coarse as facets of eyes and usually separated by about one to three diameters; basal side of disk with two irregularly shaped small depressions near lateral carina. *Abdomen* with plastron absent on disk of first three sternites, but occasionally present on extreme posterior margin of third; fourth sternite with a narrow, anterior area of disk plastron-free. First sternite with disk steeply sloping downwards (ventral view) from caudal to anterior margin;



FIGS 13-14. *Microcylloepus carinatus*. (13) Dorsal view of male genitalia. (14) Male genitalia as seen from left side.

sublateral carinae prominent, nearly parallel, and nearly extending to posterior margin. Surface of disk of first sternite with punctures which are about as coarse as facets of eyes and are confluent to separated by two diameters; plastron-free areas of other sternites more sparsely and finely punctate than disk of first sternite. *Legs* with a plastron on distal part of front and middle trochanters; hind trochanters without a plastron except for a very narrow strip near anterior distal margin; femora with plastron absent only on distal half of ventral side of front and middle legs and all of ventral side of hind legs; tibiae without a plastron but each with grooming fringes, anterior and posterior grooming fringes on front and middle tibiae and only a posterior fringe on hind tibiae. Front tibia with a broad, prominent, acutely pointed tubercle on inner apex arising from a broadly oval depression; middle tibia (Pl. 6, figs 28-29) with a similar but less prominent tubercle; hind tibia (Pl. 6, figs 30-31) with inner apex like that of middle tibia but with tubercle less prominent.

♀. Externally similar to male except as follows: (1) elytra with sutural interval moderately strongly convex from basal two-thirds nearly to apex, whereas in the male the sutural interval is only feebly convex on apical third; (2) apex of each elytron (Text-fig. 12) acutely produced, and in some specimens the spine thus formed is slightly bent laterally, whereas in the male the apices of the elytra are broadly and conjointly rounded; (3) metasternal disk less strongly and extensively concave than that of male; (4) fifth abdominal sternite strongly gibbous so that apical third is nearly vertical; and (5) tibiae without tubercles near inner apices.

#### SPECIMENS EXAMINED.

Holotype ♂, TRINIDAD: St Cruz River, 2. xi. 1937 (*H. E. Hinton*). In the British Museum (Natural History).

TRINIDAD: 171 ex., with same data as holotype; 16 ex., Maraval River, 2. xi. 1937 (*H. E. Hinton*); 22 ex., St Ann's River, 28. x. 1937 (*H. E. Hinton*); 10 ex., Curumpalo River, 2. xi. 1937 (*H. E. Hinton*); 4 ex., Curucaye River, 2. xi. 1937 (*H. E. Hinton*); 9 ex., Cimaronero River, 2. xi. 1937 (*H. E. Hinton*); 22 ex., Tacarigua River, 31. x. 1937 (*H. E. Hinton*); 103 ex., streams in Maracas Valley, 29-31. x. 1937 (*H. E. Hinton*); 46 ex., Garden River, 31. x. 1937 (*H. E. Hinton*); 19 ex., Cuare River, 5. xi. 1937 (*H. E. Hinton*); 2 ex., Arima River, 16. xii. 1969 (*H. B. N. Hynes*); 133 ex., Mausica River, 31. x. 1937 (*H. E. Hinton*). TOBAGO: 41 ex., Providence River, 1. ex, Craig Hall River, 41 ex., Courland River, 4 ex., Hillsborough West River, all 6. xi. 1937 (*H. E. Hinton*).

COMPARATIVE NOTES. The structure of the pronotum together with the absence of a plastron on the elytral epipleura place this in the *M. inaequalis* (Sharp, 1882) species-group. The tubercles on the inner apices of the male tibiae and the spinose apices of the elytra of the female will serve to distinguish this species from all other known members of the genus.

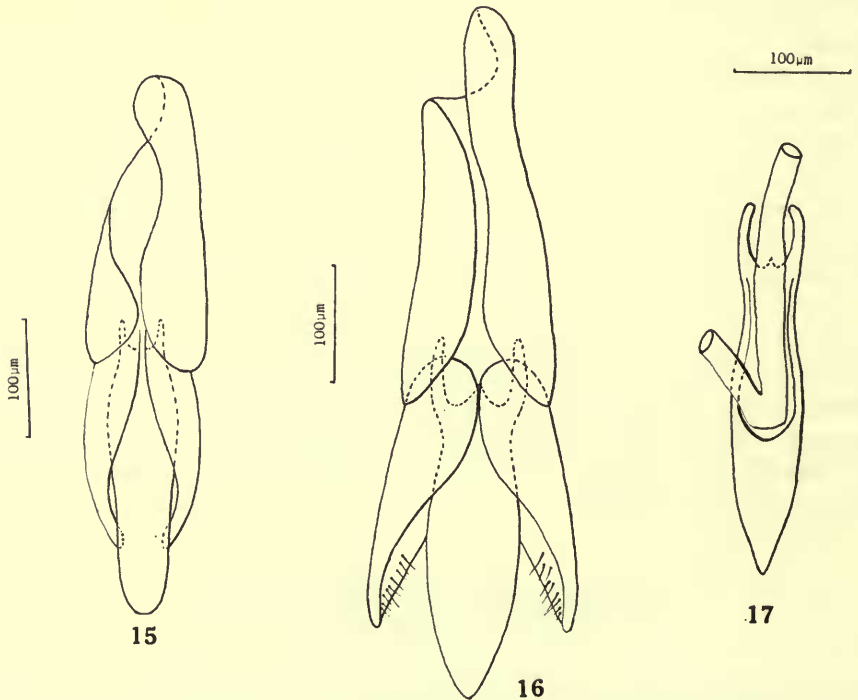
### *Hexacylloepus smithi* (Grouvelle)

(Pl. 7; Text-figs 4, 15)

*Helmis Smithi* Grouvelle, 1898, *Notes Leyden Mus.* 20 : 47. 3 syntypes, GRENADA: Mount Gay Estate (1 in BMNH, 2 in Muséum National d'Histoire Naturelle, Paris) [1 syntype examined].

♂. Length 1.7-2.0 mm; breadth 0.71-0.78 mm. Cuticle feebly shining and moderately pale yellowish brown to black; in dark specimens antennae, mouth-parts, and tarsi are distinctly paler than body. *Head* with round to oblong granules about three-fourths as coarse as facets

of eyes and usually separated by two to three diameters. Clypeus granulate like head. Labrum with microscopic punctures that are often separated by about their diameters. *Pronotum* across broadest point, which is at about basal third, broader than long (0.60 mm : 0.53 mm) and base broader than apex (0.58 mm : 0.45 mm). Median discal depression about as broad or a little broader than scutellum and extending from near base to about apical fourth where it is strongly narrowed and very shallow to apex. Basal third near each sublateral carina shallowly, indistinctly depressed. Surface (Pl. 7, figs 33-34) with flat-topped granules and punctures as illustrated. *Hypomera* with transverse plastron belt reaching edge of pronotum and extending anteriorly along the edge in a gradually narrowing strip that nearly reaches apex. Plastron-free areas with a reticulate microsculpture and a few low granules. *Elytra* with apices feebly produced and conjointly, broadly rounded. Epipleura with plastron extending almost to extreme apex. Sublateral carinae moderately prominent. Fourth interval (Pl. 7, fig. 33) on basal fifth nearly as elevated as sublateral carinae. Discal strial punctures one-half to two-thirds as wide as intervals and separated longitudinally by about their diameters. Surface of intervals with granules and punctures as shown in Pl. 7, fig. 33. *Prosternum* with plastron belt extending from margin of coxal cavity and gradually becoming wider anteriorly and almost reaching sublateral carina. *Metasternum* (Pl. 7, fig. 32) with granules somewhat coarser and sparser than those of pronotal disk. *Abdomen* everywhere with a plastron except on disk of first sternite. Disk of first sternite moderately depressed; surface sculptured like pronotal disk except near posterior margin where granules are absent. *Legs* with trochanters, femora, and



FIGS 15-17. (15) *Mexacylloepus smithi*, dorsal view of male genitalia. (16-17) *Heterelmis simplex codrus*. (16) Dorsal view of male genitalia. (17) Ventral view of median lobe. The median lobe varies somewhat in thickness, and the extremes are shown in these figures.



tibiae entirely clothed with plastron microtrichia. Front tibia with a single apical grooming fringe; middle tibia with two apical grooming fringes; hind tibia with a single apical grooming fringe. Middle tibia with a row of 10 small, stout spines on inner or ventral edge (Pl. 7, fig. 37). *Genitalia* (Text-fig. 15) with median lobe broad and extending well beyond apices of parameres.

♀. Externally similar to male but with disk of first abdominal sternite slightly less depressed and inner edge of middle tibia without a row of stout spines.

#### SPECIMENS EXAMINED.

Syntype, sex undetermined, GRENADA: (leeward side) Mount Gay Estate (*H. H. Smith*). In the British Museum (Natural History).

GRENADA: 1 ex., St John's River (*H. H. Smith*); TRINIDAD: 37 ex., Maraval River, 281 ex., St Ann's River, 5 ex., Curumpalo River, 2 ex., Curucaye River, 108 ex., Cimaronero River, 185 ex., St. Cruz River, 351 ex., Tacarigua River, 68 ex., Garden River, 572 ex., Maracas Valley, 24 ex., Cuare River, 255 ex., Mausica River, all 28. x.-5. xi. 1937 (*H. E. Hinton*); 1 ex., St Joseph River, 16. xii. 1969 (*H. B. N. Hynes*); 23 ex., Arima River, 16. xii. 1969 (*H. B. N. Hynes*); TOBAGO: 1 ex., Providence River, 6. xi. 1937 (*H. E. Hinton*).

COMPARATIVE NOTES. This species belongs to the *H. ferruginea* (Horn, 1870) group. It is closely related to *H. abditus* (Hinton) of Mexico but differs in the structure of the male genitalia (cf. Hinton, 1937, figs 13-14). In *H. abditus* the transverse plastron belt of the hypomera does not extend forwards close to the edge of the pronotum as it does in *H. smithi*.

### *Heterelmis simplex codrus* subsp. n.

(Pls 8, 9; Text-figs 2, 16, 17)

♂. Length 1.7-2.1 mm; breadth 0.8-1.0 mm. Body obovate. Cuticle moderately shining and brownish to black; in dark specimens antennae, mouth-parts, and legs are paler and reddish brown. *Head* with low granules about two-thirds as coarse as facets of eyes and usually separated by two or more diameters; surface between granules densely, microscopically punctate. *Pronotum* at broadest point, which is at about basal third, broader than long (0.73 mm : 0.60 mm) and base broader than apex (0.71 mm : 0.50 mm). Sublateral carinae prominent, complete from base to apex, and inner or dorso-mesal margins sharp; at about third carinae slightly bent where they meet the oblique, subbasal depression on each side; subbasal oblique depression usually shallow and indistinct. Disk usually without a transverse depression just behind middle; some specimens with a wide and very shallow depression; usually with a shallow, oval, median, discal depression that is about half as wide as scutellum. Surface of middle of disk with punctures slightly finer than facets of eyes and usually separated by one to three diameters; in Pl. 8, fig. 41, punctures appear sparser than they are because some have been filled in by metal. *Hypomera* with plastron belt above coxal cavity less than half as wide as hypomera above coxae; plastron extends to anterior margin as a very narrow strip (half as wide as basal tarsal segment) against sterno-notal suture. Surface with low granules and dense, microscopic punctures. *Elytra* with extreme apices feebly dehiscent. Epipleura with plastron extending close to apex. Sublateral carinae moderately prominent, other intervals flat. Strial punctures as shown in Pl. 8, fig. 38. *Prosternum* with plastron complete on side between sterno-notal suture and sublateral carina except for a very small patch at apex against

carina. Metasternal disk (Pl. 8, figs 39-40) feebly convex; plastron not extending mesally beyond a point opposite middle of middle coxal cavities. *Abdomen* with discal area of all sternites plastron-free; disk of first two sternites with punctures about as coarse as facets of eyes and separated by one to three diameters; disk of sternites 3-5 with punctures distinctly finer and sparser. First sternite with sublateral discal carinae prominent and extending to hind margin of sternite. *Legs* with plastron present on front and middle trochanters but absent on hind trochanter (Pl. 9, fig. 48). Front and middle femora with plastron absent on distal third; hind femora with plastron absent on distal half of top and sides and all of ventral side. Tibiae without a plastron but with two apical grooming fringes on front and middle tibiae and a single grooming fringe on hind tibiae. *Genitalia* (Text-fig. 16) with median lobe evenly narrowed and extending beyond apices of parameres.

♀. Externally similar to male.

Holotype ♂, TRINIDAD: Maracas Valley, 29. x. 1937 (*H. E. Hinton*). In the British Museum (Natural History).

Paratypes. TRINIDAD: 732 ex., with same data as holotype; 47 ex., Maraval River, 674 ex., St Ann's River, 45 ex., Curumpalo River, 118 ex., Curucaye River, 2 ex., Cimaronero River; 143 ex., St Cruz River, 19 ex., Garden River, 38 ex., Cuare River, 5 ex., Marianne River, all 28. x.-5. xi. 1937 (*H. E. Hinton*); 1 ex., St Joseph River, 16. xii. 1969 (*H. B. N. Hynes*); 15 ex., Arima River, 16. xii. 1969 (*H. B. N. Hynes*); TOBAGO: 14 ex., Providence River, 7 ex., Courland River, 6 ex., Hillsborough West River, all 6. xi. 1937 (*H. E. Hinton*).

COMPARATIVE NOTES. *H. simplex* Sharp, 1882 has not been recorded outside Guatemala. Fifteen specimens of *H. simplex* taken in Guatemala near Escuintla in March 1970 by Dr H. B. N. Hynes have been compared with the series from Trinidad and Tobago. The distribution of the plastron in *H. simplex simplex* and *H. simplex codrus* is identical in all respects. However, the median lobe of the male genitalia of *H. s. codrus* is slightly but distinctly broader than that of *H. s. simplex* and the setae on the parameres are shorter and less numerous. When populations from further south on the mainland are examined, it may well be that all gradations between the two subspecies will be found in the structure of the male genitalia.

#### ACKNOWLEDGEMENTS

I am grateful to the Managers of the Balfour Fund and the Worts Fund of the University of Cambridge for grants that enabled me to collect in Trinidad and Tobago in 1937. My thanks are due to the Science Research Council for providing me with a scanning electron microscope.

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